REMARKS

By a Preliminary Amendment filed on February 19, 1999, the specification has been amended to correct the informalities noted by the Examiner. Further, the specification has been amended to correct informalities and to clarify what properties of a metal and what properties of an insulator are being referred to. Specifically, the specification has been amended to state that emissivity characteristics of a metal and insulator are being referred to. No new matter has been added. Support for this clarification is found at least at Figure 3, and page 5, lines 23-25, and page 7, lines 16-19.

Applicants are currently having the article by Akira Okamoto translated into English. This translation will be forwarded to the Examiner as soon as it is received by Applicants' representative.

By this Amendment, claims 1, 4, 5, 11-14, and 16-18 have been amended in response to the rejection of the claims as being indefinite under 35 U.S.C. §112, second paragraph. The subject matter of claims 2, 3 and 7-10 have been incorporated into claim 1, and claims 2, 3 and 7-10 have accordingly been canceled. Claims 11 and 16 have been written in independent form. As amended, it is believed that the claims are clear and definite and, therefore, withdrawal of the rejection of the claims under 35 U.S.C. §112, second paragraph, is respectfully requested.

Claims 1-4, 7, 8, 11-13, 16, 17, 20, and 25-29 were additionally rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,565,671 to Teeg et al. in view of U.S. Patent 5,562,154 to Benson et al. Claims 5, 6, 9, 10, 14, 15, 18, 19, and 21-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,565,671 to Teeg et al. in view of U.S. Patent 5,562,154 to Benson et al., and further in view of U.S. Patent No. 5,608,414 to Amore. These rejections are respectfully traversed.

At the outset, it should be understood that none of the references teach or suggest the substance used in the claimed thermal control devices. Claim 1 is directed toward a heat control device that comprises, inter alia, a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$, where A is at least one of La, Pr, Nd and Sm rare earth ions, and B is at least one of Ca, Sr and Ba alkaline rare earth ions. Applicants discovered that this substance exhibits emissivity characteristics which are dependent upon temperature, and more specifically that this substance exhibits emissivity characteristics of an insulator at a relatively high temperature and exhibits emissivity characteristics of a metal at a relatively low temperature. None of the references of record teach or suggest these features.

The Teeg patent discloses a vanadium dioxide layer having transmissivity characteristics (i.e., color) which change with temperature. (See column 3, lines 28-31). Teeg does not teach or suggest that this vanadium dioxide coating changes emissivity properties based on temperature changes. Consequently, it is clear that Teeg does not teach or suggest a substance which exhibits the emissivity characteristics of an insulator at a relatively high temperature and exhibits the emissivity characteristics of a metal at a relatively low temperature.

To make up for this deficiency of the Teeg patent, the Benson patent was cited. Benson discloses a vanadium oxide layer 170 which changes emissivity as a function of temperature. (See column 7, line 53 - column 8, line 11). By changing emissivity, layer 170 varies heat transfer through a panel to which it is adhered.

While the vanadium oxide layer of Benson has an emissivity which is temperature dependent, it is different from the claimed invention in at least one important respect. The emissivity of the substance recited in claim 1, i.e., a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$, demonstrates what is known as a positive temperature dependence. A substance

which demonstrates a positive temperature dependence is one which as a high emissivity in high temperatures and a low emissivity at low temperatures.

The Benson coating, however, demonstrates the exact opposite effect. The coating demonstrates negative temperature dependence, which means that it has a low emissivity at high temperatures and a high emissivity at low temperatures. Such a substance is clearly inappropriate for space use since it would not protect an space vehicle from heat during orbit re-entry. In fact, it would transfer heat to the vehicle thereby causing the vehicle to effectively melt.

By disclosing a coating with a negative emissivity temperature dependence in Benson and a coating with only a transmissivity dependence in Teeg, it is clear that the Teeg and Benson patents do not teach or suggest a substance which exhibits emissivity characteristics of an insulator at a relatively high temperature and exhibits emissivity characteristics of a metal at a relatively low temperature, as recited in claim 1. Consequently, any combination formed between these two patents would also fail to include the substance recited in claim 1.

Applicants further emphasize that the Teeg and Benson patents do not teach or suggest the specific structure of the substance recited in claim 1. Specifically, none of the coatings disclosed in the Teeg and Benson patents correspond to a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$, where A is at least one of La, Pr, Nd, and Sm rare earth ions and B is at least one of Ca, Sr, and Ba alkaline earth ions. Instead, Teeg discloses only a vanadium dioxide coating and Benson discloses coatings comprised of vanadium oxide, nickel hydroxide ($Ni(OH)_2$), tungsten trioxide (WO_3), titanium oxide (Ti_2O_3), nickel sulfide (NiS), and vanadium oxy fluoride ($VO_{2-x}F_x$).

In the Office Action, the Examiner essentially took the position that the replacement of one variable-emissivity coating with another would have been obvious. Applicants respectfully submit that this is not the case. First, as discussed

above, there are different types of emissivity coatings. One type has its emissivity properties increase with increases in temperature and the second type has its emissivity decrease with increases in temperature. The coatings disclosed in the Benson and Teeg patents are of the second type, while the first type corresponds to the substance of the claimed invention. That is, neither Teeg nor Benson, nor any of the other references of record, teach or suggest a coating having a positive temperature dependence.

Second, the variable-emissivity substance of the claimed invention (i.e., a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$, where A is at least one of La, Pr, Nd, and Sm rare earth ions and B is at least one of Ca, Sr, and Ba alkaline earth ions) demonstrates superior performance relative to all of the coatings disclosed in the Teeg and Benson patents. More precisely, a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$ demonstrates a larger emissivity variation against temperature compared with the coatings disclosed in the Teeg and Benson patents.

In addition, the substance of the claimed invention may have a convenient transition temperature near room temperature, a feature which the coatings of Teeg and Benson also do not demonstrate. Since most satellite electrical components have a low operational temperature limit at -30° C to 0° C, a transition temperature at approximately room temperature is highly preferable and thus makes the substance $A_{1-x}B_xMnO_3$ of the claimed invention even that more appealing to designers. In contrast, vanadium oxide and vanadium dioxde coatings such as disclosed in Teeg and Benson are inferior because their transition temperatures are at 65° C.

Based on at least the foregoing differences, it is respectfully submitted that claim 1 and its dependent claims are patentably distinguishable from a Teeg-Benson combination.

New claim 30 recites that a transition temperature of the substance of claim 1 depends upon a value of **x** in the perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$ causes a transition temperature. This dependence advantageously allows a designer to modify the transition temperature of the substance of the claimed invention simply by changing "x" in the formula $A_{1-x}B_xMnO_3$. None of these features are taught or suggested in the Teeg and Benson patents.

Claims 11 and 16 recites many of the features which patentably distinguish claim 1 from a Teeg-Benson combination. For example, claim 11 and 16 recite a substance which exhibits emissivity characteristics of an insulator at relatively high temperature and emissivity characteristics of a metal at relative low temperature. Claim 11 further recites that this substance has a relatively low emissivity at relatively low temperatures and a relatively high emissivity at relatively high temperatures, i.e., a substance whose emissivity has a positive temperature dependence. None of these features are taught or suggested by the Teeg and Benson patents.

Based on at least these differences, it is respectfully submitted that claims 11 and 16 and their dependent claims are allowable over a Teeg-Benson combination.

Claims 5, 6, 9, 10, 14, 15, 18, 19, and 21-24 were rejected under 35 USC § 103(a) for being obvious over a Teeg-Benson-Amore combination. This rejection is traversed for the following reasons.

All of these claims, which are still pending, depend either directly or indirectly on claims 1, 11, or 16. In order to render these dependent claims obvious, the Amore patent must teach or suggest the features of claims 1, 11, and 16 which are missing from a Teeg-Benson combination.

The Amore patent discloses the use of silicon or germanium coatings to protect spacecraft components from solar radio. Amore, however, does not teach or suggest any of the features noted above which patentably distinguish claims 1, 11, and 16 from a Teeg-Benson combination. It is therefore respectfully submitted that the claims which depend from claims 1, 11, and 16 are allowable over a Teeg-Benson-Amore combination.

Reconsideration and withdrawal of all the rejections and objections made by the Examiner is hereby respectfully requested.

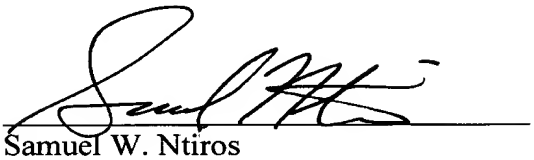
In view of the foregoing amendments and remarks, it is respectfully submitted that the application is in condition for allowance. Favorable consideration and prompt allowance of the application is respectfully requested.

Should the Examiner believe that further amendments are necessary to place the application in condition for allowance, or if the Examiner believes that a personal interview would be advantageous in order to more expeditiously resolve any remaining issues, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR § 1.136. Please charge any shortage in fees due in connection with this application, including extension of time fees, to Deposit Account No. 23-1951

(Case No. 130033AA) and please credit any excess fees to the same Deposit Account.

Respectfully submitted,



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